Executive Ballroom 210E | **Executive Ballroom 210F** | **Executive Ballroom 210G** | **Executive Ballroom 210H**

Executive Ballroom 210E

CLEO: Science & Innovations

SF3E • Ultrafast Oscillators—Continued

SF3E.4 • 14:45
21 W average power sub-100-fs Yb:Lu_2O_3 thin-disk laser, Norbert Modsching[1], Jakub Drs[1], Julian Fischer[1], Clément Paradis[1], François Labaye[1], Maxim Gaponenko[1], Christian Kränkel[2], Valentin J. Wittwer[1], Thomas Südmeyer[1]; [1]*Laboratoire Temps-Fréquence, Université de Neuchâtel, Switzerland;* [2]*Center for Laser Materials, Leibniz-Institut für Kristallzüchtung, Germany.* We demonstrate a Kerr lens mode-locked thin-disk laser oscillator operating with 95-fs pulses at 21.1 W of average power. This is the highest average power achieved by any oscillator in the sub-100-fs regime.

SF3E.5 • 15:00
Three-element-cavity enables Kerr-lens mode-locking at 20-GHz repetition rate, Shota Kimura[1], Shuntaro Tani[1], Yohei Kobayashi[1]; [1]*The Univ. of Tokyo, Japan.* We propose a new cavity design for a compact Kerr-lens mode-locked laser using only three optical elements. The repetition rate of 20 GHz was achieved with the pulse duration of 120 fs.

SF3E.6 • 15:15
Graphene mode-locked Tm,Ho:CLNGG laser with 70-fs pulse duration, Yongguang Zhao[1], Weidong Chen[1], Valentin Petrov[1], Li Wang[1], Yicheng Wang[1], Zhongben Pan[1], Xiaojun Dai[2], Hualei Yuan[2], Yan Zhang[2], Huaqiang Cai[2], Ji Eun Bae[3], Sun Young Choi[3], Fabian Rotermund[3], Pavel Loiko[4], Josep Serres[5], Xavier Mateos[5], Wei Zhou[6], Deyuan Shen[6], Uwe Griebner[1]; [1]*Max-Born Inst., Germany;* [2]*China Academy of Engineering Physics, China;* [3]*Dept. of Physics, South Korea Advanced Inst. of Science and Technology (KAIST), South Korea (the Republic of);* [4]*ITMO Univ., Russia;* [5]*Universitat Rovira i Virgili, Spain;* [6]*Jiangsu Normal Univ., China.* We report on a mode-locked Tm,Ho:CLNGG laser employing graphene as a saturable absorber. Pulses as short as 70 fs, i.e., 10 optical cycles, are generated at 2093 nm with a repetition rate of ~89 MHz.

SF3E.7 • 15:30
Sub-10 fs Pulse Generation From a Blue-Diode-Pumped Kerr-Lens Mode-Locked Ti:sapphire Laser, Han Liu[1], Geyang Wang[1], Ke Yang[1], Renzhu Kang[1], Wenlong Tian[1], Dacheng Zhang[1], Liang Guo[1], Jiangfeng Zhu[1], Zhiyi Wei[2]; [1]*Xidian Univ., China;* [2]*Chinese Academy of Sciences, Beijing National Lab for Condensed Matter Physics, Inst. of Physics, China.* We demonstrate a blue-diode pumped Kerr-lens mode-locked Ti:sapphire laser generating sub-10 fs pulses for the first time. The laser is centered at 830 nm with 113 nm bandwidth and 22 mW average power.

Executive Ballroom 210F

Joint

JF3F • Symposium on Deep-learning Photons: Where Machine Learning & Photonics Intersect III—Continued

JF3F.2 • 15:00 Invited
Training of Photonic Neural Networks through *In Situ* Backpropagation, Tyler Hughes[1], Momchil Minkov[1], Ian Williamson[1], Yu Shi[1], Shanhui Fan[1]; [1]*Stanford Univ., USA.* We provide a protocol for training photonic neural networks based on adjoint methods. The gradient of the network with respect to its tunable degrees of freedom is computed by physically backpropagating an optical error signal.

JF3F.3 • 15:30 Invited
Deep Imaging Cytometry. Yueqin Li[1], Ata Mahjoubfar[1], Bahram Jalali[1], Kayvan Niazi[2]; [1]*UCLA, USA,* [2]*Nantworks, USA.* We describe a new implementation of our deep learning time-stretch imaging flow cytometry which avoids data pre-processing and feature extraction. The neural network classifies cancer cells by directly processing the raw serial temporal data.

Executive Ballroom 210G

CLEO: Science & Innovations

SF3G • Laser-Based 2D/3D Micro- & Nano-fabrication—Continued

SF3G.4 • 14:45
Two-photon induced chiral mass-transport of azo-polymers as a function of pulse duration, Keigo Masuda[1], Yoshinori Kinezuka[1], Mitsuki Ichijo[1], Ryo Shinozaki[1], Keisaku Yamane[2], Kohei Toyoda[1,3], Katsuhiko Miyamoto[1,3], Takashige Omatsu[1,3]; [1]*Chiba Univ., Japan;* [2]*Hokkaido Univ., Japan;* [3]*MCRC Chiba Univ., Japan.* We demonstrated two-photon-absorption induced chiral surface relief formation in an azo-polymer film by illumination of picosecond 1-μm optical vortex pulses. The chiral surface relief formation required at least several times the response-time of trans-cis isomerization.

SF3G.5 • 15:00 Invited
Functionalizing Glass by Local Compositional Tuning with Ultrafast Lasers, Javier Solis[1]; [1]*Instituto De Optica 'Daza De Valdes', Spain.* The presentation provides an overview of fs-laser induced ion migration phenomena in glass, with emphasis on recent results of our research group regarding its application for the production of efficient photonic devices.

SF3G.6 • 15:30
Rapid Femtosecond Laser 3D microfabrication using Focal Field Engineering, Yan Li[1], Dong Yang[1], Lipu Liu[1], Hong Yang[1], Qihuang Gong[1]; [1]*Peking Univ., China.* We realize the single-exposure and the single-scan femtosecond laser microfabrication of 3D microstructures by the 3D focal field intensity engineering. The two rapid techniques are further integrated to fabricate a microstructure.

Executive Ballroom 210H

SF3H • Microresonator Frequency Combs—Continued

SF3H.3 • 14:45
Si-chip frequency combs with 2-octaves bandwidth for longwave-IR gas and liquid dual-comb spectroscopy, Nima Nader[1], Jeff Chiles[1], Henry Timmers[1], Eric J. Stanton[1], Abijith Kowligy[1], Alexander Lind[1,2], Sae Woo Nam[1], Scott A. Diddams[1,2], Richard P. Mirin[1]; [1]*National Inst. of Standards and Tech, USA;* [2]*Physics, Univ. Of Colorado, Boulder, USA.* We use suspended-silicon waveguides for spectral engineering of mid-infrared frequency combs to achieve spectra spanning 2.0 octaves (2-8.5 μm). We demonstrate dual-comb spectroscopy of gas and liquid-phase samples with 100 MHz comb-line resolution.

SF3H.4 • 15:00
Silicon-Chip-Based *f-2f* Interferometer, Yoshitomo Okawachi[1], Mengjie Yu[1,2], Jaime Cardenas[1], Xingchen Ji[1,2], Michal Lipson[1], Alexander Gaeta[1]; [1]*Columbia Univ., USA;* [2]*Cornell Univ., USA.* Using a single silicon-nitride waveguide, we demonstrate an *f-2f* interferometer for carrier-envelope-offset frequency (f_{CEO}) detection by simultaneous supercontinuum generation and second-harmonic generation. We measure a f_{CEO} beatnote with a 27-dB SNR with 62-pJ pulse energies.

SF3H.5 • 15:30
Microwatt-Level Soliton Frequency Comb Generation in Microresonators Using an Auxiliary Laser, Shuangyou Zhang[1], Jonathan M. Silver[1], Leonardo Del Bino[1], Francois Copie[1], Michael T. M. Woodley[1], George Ghalanos[1], Andreas Svela[1], Niall Moroney[1], Pascal DelHaye[1]; [1]*National Physical Lab, UK.* We report a simple and robust method to generate soliton frequency combs in microresonators assisted by an auxiliary laser. Our method significantly enhances the soliton access range and enables threshold powers down to 780 microwatt.